Figure 8 — Annual fall-run escapement to Sacramento River and major tributaries.

- The estimate includes spawning in the mainstem Sacramento as well as the American, Feather, and Yuba rivers and Battle Creek.
- Total estimated escapement was the third highest since 1970 and more than met the PFMC goal of 122,000-180,000 spawners in the Central Valley.

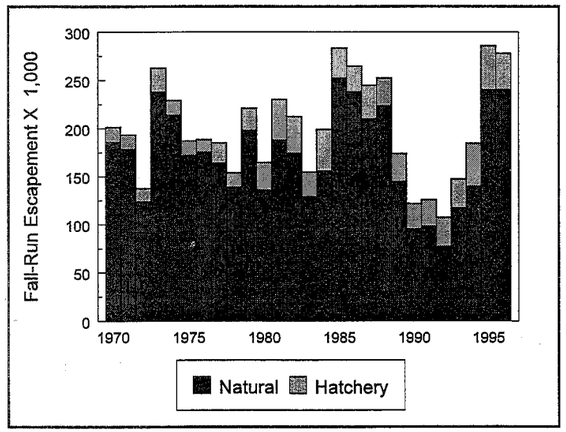

Figure 8
ANNUAL FALL-RUN ESCAPEMENT TO THE SACRAMENTO RIVER AND MAJOR TRIBUTARIES, NATURAL AND HATCHERY CONTRIBUTIONS
Preliminary DFG Data

Figure 9 — Annual fall chinook escapement to the San Joaquin River system.

- These data include the Mokelumne, Stanislaus, Tuolumne, and Merced rivers. There are hatcheries on the Mokelumne and Merced rivers.
- There are presently only fall chinook in the San Joaquin system.
- Although San Joaquin system escapement was by far the best since 1990, it did not approach some of the high runs seen in the mid-1980s.

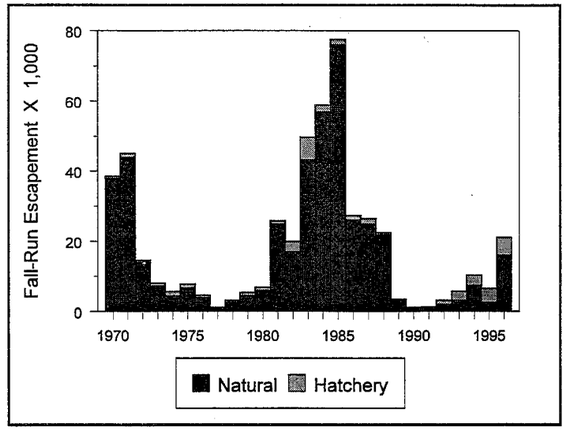

Figure 9
ANNUAL FALL-RUN ESCAPEMENT TO THE SAN JOAQUIN RIVER SYSTEM, NATURAL AND HATCHERY CONTRIBUTION
Preliminary DFG Data

American Shad

Jane D. Arnold and Lee W. Miller, DFG

The abundance of young striped bass and other species has declined in the fall midwater trawl in recent years, but abundance of American shad has been increasing. The American shad mean abundance index was 1,653 for 1967-1976 and 2,750 for 1977-1996, a 40% increase (Figure 1). A record high index of 6,859 was recorded for American shad in 1995; in 1996, the index was 4,312, the fifth highest of record. The five highest indices for American shad have all been since 1982 — the same period in which the lowest striped bass indices were measured.

In the 1996 survey, American shad were found from San Pablo Bay and throughout the delta during September-December. However, by December fewer fish were caught in the delta as most of the fish moved out of the estuary (Figure 2).

To find out more about the fall midwater trawl survey and American shad results, look on the Internet at www.delta.dfg.ca.gov/mwt96/.

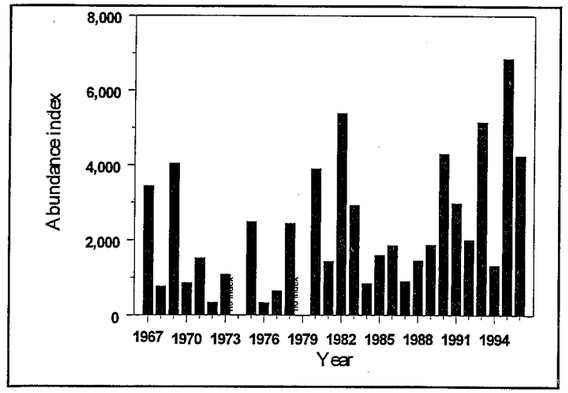

Figure 1
ABUNDANCE INDICES FOR AMERICAN SHAD BASED ON SEPTEMBER-DECEMBER FALL MIDWATER TRAWL SURVEYS
No survey in 1974 and 1979.

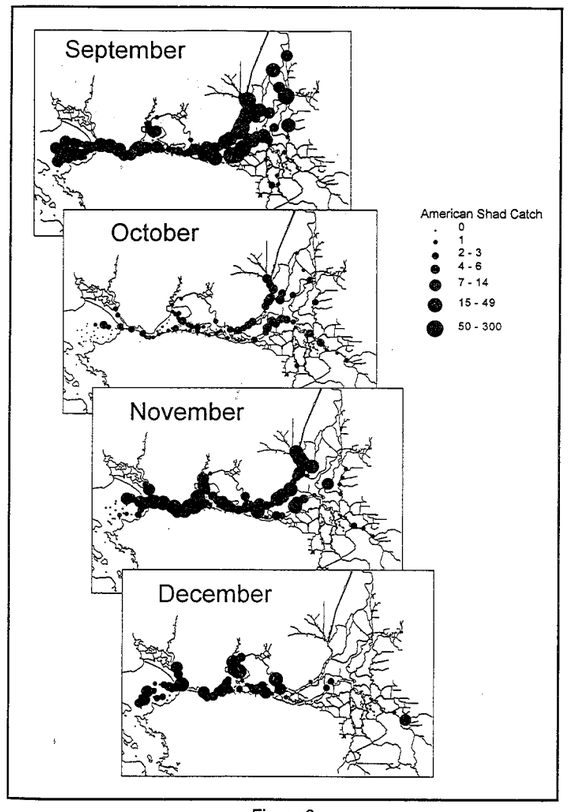

Figure 2
DISTRIBUTION OF AMERICAN SHAD IN THE 1996 FALL MIDWATER TRAWL SURVEY

Young Striped Bass

Jane D. Arnold, Stephen F. Foss, and Lee W. Miller

The summer tow-net survey measures an index of striped bass abundance when the population mean size is 38mm. In 1996, the index was 2.1, the lowest since 1959, when the survey began (Figure 1). The 1996 index was lower than expected, based on the high mean April-July delta outflow. Possible causes of the lower index were discussed in "Low Striped Bass Index for 1996" in the Autumn 1996 *Newsletter*. Results from 1996 were similar to those of 1995, when we reported a similar unusually low young bass index for the water year type (discussed in the Summer 1996 *Newsletter*).

The fall midwater trawl survey measures abundance of young striped bass and other species of interest. The survey has been conducted annually since 1967 except in 1974 and 1979, with a total of 28 years surveyed. The fall midwater trawl abundance index is the sum of monthly indices for September-December.

The 1996 fall midwater trawl abundance index for young striped bass was 388, the lowest index of record; the 1995 index of 479 was the third lowest of record (Figure 2), continuing the trend since 1977. For 1977-1996, the index has averaged 2,571 — 65% lower than the average of 7,350 for 1967-1976.

High mean April-July outflow usually produces larger striped bass year classes than low flow, but despite high flows in 1995 and 1996, the fall midwater trawl abundance indices for those years were very low. However, these low fall abundance indices corroborate the low striped bass abundance as measured by the summer tow-net survey. Fall striped bass abundance usually reflects the summer abundance, because the two sets of indices are strongly correlated ($r=0.85$, $p=0.0001$).

Young striped bass were found in Suisun Bay and the delta from September through November. In December, striped bass distribution expanded into San Pablo Bay (Figure 3). Abundance also increased markedly in December following winter storms that increased outflow and turbidity. Such events apparently affect the vulnerability or availability of striped bass to the trawl. Striped bass abundance indices have often been much higher after storms than we would have expected based on the surveys preceding such events.

More information about the fall midwater trawl and striped bass results can be viewed on the Internet at www.delta.dfg.ca.gov/mwt96/.

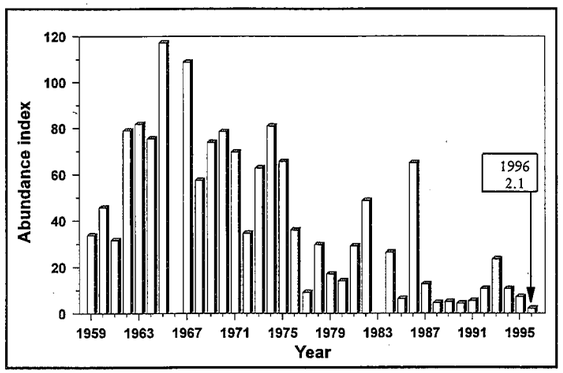

Figure 1
ABUNDANCE INDICES FOR YOUNG STRIPED BASS
WHEN CATCH LENGTH IS 38mm

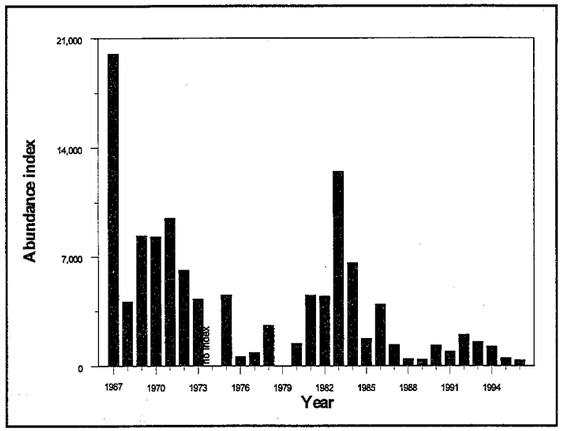

Figure 2
ABUNDANCE INDICES FOR STRIPED BASS BASED ON
SEPTEMBER-DECEMBER FALL MIDWATER TRAWL SURVEYS
No survey in 1974 and 1979.

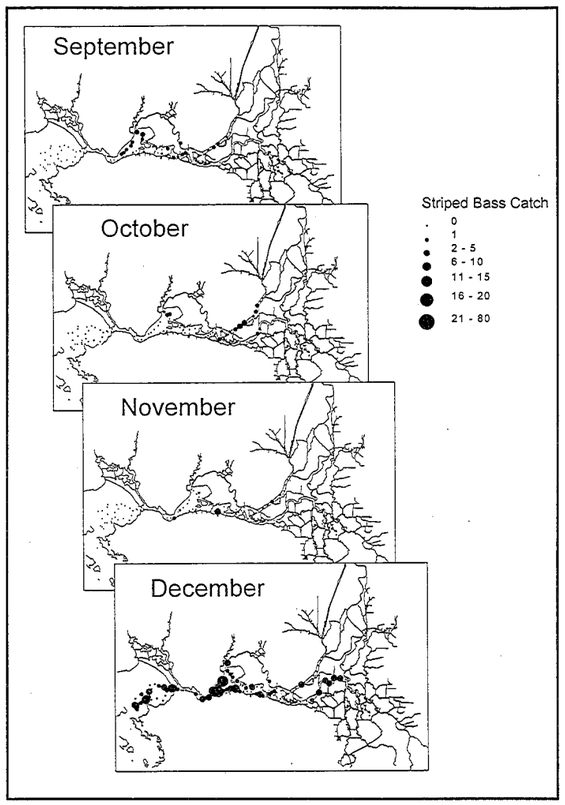

Figure 3
DISTRIBUTION OF STRIPED BASS IN THE
1996 FALL MIDWATER TRAWL SURVEY

Adult Striped Bass

David W. Kohlhorst, DFG

Adult striped bass population estimates, based on a mark/recapture study, are available from 1969 to 1994 (Figure 1). Striped bass were not tagged in 1995, so no abundance estimate is available for that year; the 1996 estimate is not yet available. After declining from an average of 1.7 million legal-sized fish in the early 1970s, the population seemed to be stable at a new, lower level of 825,000-1.2 million between 1977 and 1989. In 1990, the estimate decreased to 651,000 and has since declined to the lowest level on record of 604,000 in 1993 before rebounding somewhat to 712,000 in 1994.

Estimates of recruitment have varied much more than total legal-sized abundance during 1977-1993 (Figure 2), while showing a decline similar to that of all legal-sized adults. The age-3 abundance estimate has ranged from 314,000 in 1989 to 1.2 million in 1978. The 1994 estimate of 960,000, based only on recaptures from the first creel census after tagging, will probably decrease when a larger recapture sample is available; that has been the pattern in recent population estimates. (About half the age-3 fish are legal-sized at the time the estimate is made, so only half of the age-3 fish are included in the legal-sized adult estimate above.) Variation in the age-4 estimate has been from 103,000 in 1994 to 560,000 in 1980. The variability of the recruitment estimates (especially for age 3) is partly due to real variability in recruitment, but it also is influenced by small numbers of tag recaptures in some recent years and the effect of aging errors.

All ages of adult striped bass have decreased in abundance over the last 20 years (Figure 2). The decline from 1969-1973 to 1990-1994 has ranged from 49% for age 3 and age 5 bass to 80% for bass age 8 and above, the oldest fish in the population (Figure 3).

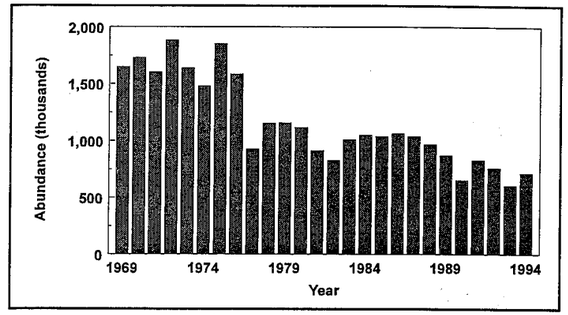

Figure 1
ESTIMATED ABUNDANCE OF LEGAL-SIZED STRIPED BASS

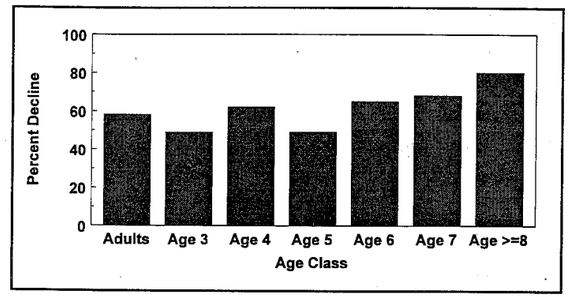

Figure 3
PERCENTAGE OF DECLINE IN EACH AGE CLASS OF
STRIPED BASS BETWEEN 1969-1973 AND 1990-1994

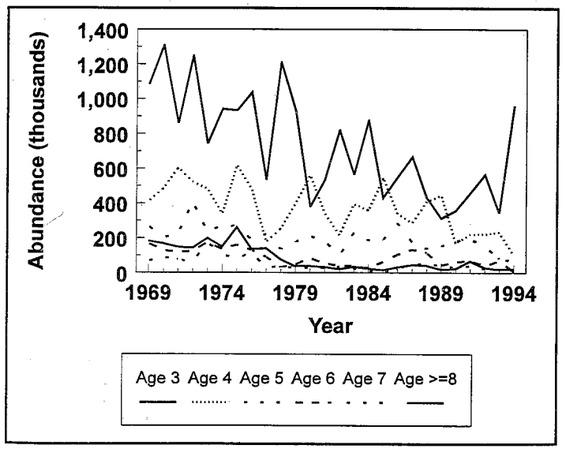

Figure 2
ESTIMATED ABUNDANCE OF STRIPED BASS, BY AGE

During this same period, mortality rates of adult striped bass have changed also. Estimated total annual mortality rate has shown a significantly increasing trend since 1969 and reached its highest level (0.67) in 1993 (Figure 4). This change in total mortality is the result of a significant increase in estimated "natural mortality" (due to factors other than legal fishing) rate from 1969-1993, while estimated harvest rate exhibited a significant downward trend.

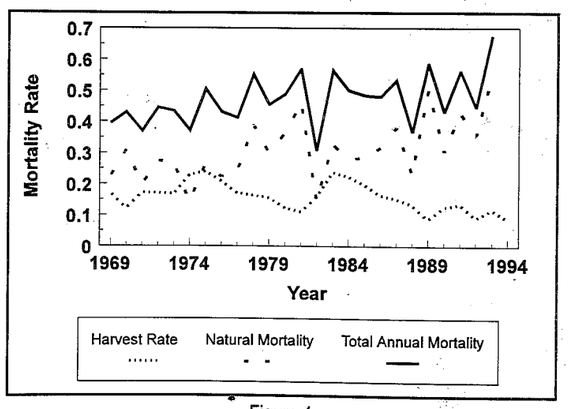

Figure 4
MORTALITY RATES OF ADULT STRIPED BASS